

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

1. (Currently amended) A system for managing multiple links in a label switched network, comprising:
 - a plurality of wide band virtual links including a plurality of input virtual links and a plurality of output virtual links, each such virtual link including a plurality of physical links;
 - ~~each input or output virtual link having a plurality of individual links;~~
 - a plurality of ingress nodes, each ingress node configured to receive packets and label the packets with associated labels;
 - a plurality of label switching nodes, each label switching node configured to receive the labeled packets having respective associated labels via ~~one or more~~ input virtual links and forward the received labeled packets based on their respective associated labels via ~~one or more~~ output virtual links, each label switching node further including a control component configured to maintain label information relating to the associated labels and a forwarding component configured to perform forwarding of the received labeled packets based on the label information;
 - a plurality of egress nodes, each egress node configured to receive the labeled packets forwarded from one of the plurality of label switching nodes;
 - wherein ~~one or more~~ label switching nodes are identified as belonging to a label switched path and virtual links ~~are used to~~ interconnect the identified label switching nodes as belonging to the label switched path; and
 - wherein the ~~plurality of individual physical~~ links within each of the virtual links used to interconnect the identified label switching nodes are collectively regarded as a single entity by the control component with respect to the label switched path.

2. (Currently amended) The system of claim 1 wherein details with respect to which ones of the ~~individual~~physical links within an output virtual link are to be used to forward the received packets are concealed from the control component.

3. (Currently amended) The system of claim 1 wherein at least one of the labeled packets is capable of being forwarded to ~~any one of the~~ physical ~~plurality of individual~~ links within an output virtual link without changing its associated label ~~that is established in an~~ initial signaling process.

4. (Currently amended) The system of claim 1 wherein the associated label ~~comprises at least one of is composed of any one of the following entities or combination thereof including a single sequence of bits of fixed length, time slot position in a TDM frame and~~ wavelength of optical carrier.

5. (Currently amended) The system of claim 1 wherein each associated label belongs to one of a plurality of classes; and

wherein the associated labels are used by a label switching node to forward packets belonging to a corresponding class onto one of the plurality of physical ~~individual~~ links of an output virtual link.

6. (Currently amended) The system of claim 5 wherein the label switched network ~~comprises is a multiple protocol label switched network and the corresponding class comprises is a forwarding equivalence class.~~

7. (Currently amended) The system of claim 5 wherein a first hash function ~~is used to operate~~ operates on an associated label of a packet to be forwarded via an output virtual link to thereby obtain a hash value, the hash value representing ~~one of the plurality of a physical link individual links~~ within the output virtual link ~~that is to be used~~ to forward the packet.

8. (Currently amended) The system of claim 7 wherein by using the first hash function ~~to operate~~ on the associated label of the packet, the packet is capable of being forwarded to a one of the plurality of individual physical link ~~links~~ within the output virtual link without changing its associated label.

9. (Currently amended) The system of claim 5 wherein one of a plurality of hash functions is used to operate on respective associated labels of packets to be forwarded via an output virtual link to obtain corresponding hash values;

wherein the respective associated labels correspond to ~~one or more~~ at least one ~~class-classes~~; and

wherein the corresponding hash values represent ~~one or more of the plurality of individual~~ physical links within the output virtual link that are to be used to respectively forward the packets.

10. (Currently amended) The system of claim 9 wherein by using one of the plurality of hash functions to operate on the respective labels, the packets associated with the respective associated labels are apportioned among the ~~plurality of individual~~ physical links within the output virtual link.

11. (Currently amended) The system of claim 9 wherein the hash function used ~~which one of the plurality of hash functions is used~~ to operate on the respective associated labels depends on ~~one or more~~ at least one load balancing ~~condition~~ conditions.

12. (Original) The system of claim 7 further comprising:
a plurality of label forwarding tables, each label forwarding table having a plurality of entries, each entry including an input virtual port number, an input label, an output label and an output virtual port number; and

wherein the input virtual port number represents identification information relating to an input virtual link through which an input packet is received, the input label represents label information relating to the input packet, the output label represents label

information relating to an output packet and the output virtual port number represents identification information relating to an output virtual link through which the output packet is to be forwarded.

13. (Currently amended) The system of claim 12 wherein each label forwarding table is associated with ~~a one of the plurality of individual~~individual physical link ~~links~~ within an input virtual link.

14. (Currently amended) The system of claim 12 wherein a first label switching node forwards a packet to a second label switching node via ~~an a~~individual physical link within a virtual link coupling the first label switching node and the second label switching node;

wherein the first label switching node uses the first hash function to operate on the associated label of the forwarded packet to obtain its corresponding hash value, the corresponding hash value representing the individual physical link within the virtual link;

wherein for a label forwarding table associated with the individual physical link within the virtual link at the second label switching node, an entry is tagged if a hash value of the input label for that entry is equal to an input practical port number which corresponds to the individual physical link within the virtual link;

wherein the second label switching node uses a second hash function to obtain the hash value of the input label for that entry;

wherein the first hash function and the second hash function are synchronized.

15. (Currently amended) The system of claim 14 wherein the label forwarding table associated with the individual physical link within the virtual link at the second label switching node is modified to include only tagged entries.

16. (Currently amended) The system of claim 14 wherein when a packet is received via the individual physical link within the virtual link at the second label switching node, only the tagged entries within the label forwarding table associated with the individual physical

link within the virtual link at the second label switching node are searched for an entry corresponding to the received packet.

17. (Currently amended) A system for setting label switched paths in a label switched network, comprising:

a plurality of wide band virtual links; and

a plurality of nodes interconnected to each other via the plurality of virtual links;

and

wherein a label switched path is identified for transmitting packets through the label switched network and the path includes virtual links and nodes~~is made up of one or more links interconnecting one or more nodes~~; and

wherein each node in the label switched path further includes control logic configured to select a hash function to operate on respective labels of received packets to obtain corresponding hash values, and the corresponding hash values represent physical links within the virtual link that are to be used to forward the received packets.

~~wherein the one or more links within the label switched path include one or more virtual links; and~~

~~wherein each of the one or more virtual links is made up of one or more physical links.~~

18. (Currently amended) The system of claim 17 wherein each node in the label switched path is configured to receive packets having respective labels via ~~one or more~~ links connected thereto and forward the received packets based on their respective labels via ~~one or more~~ links connected thereto;

wherein each node in the label switched path includes a control component configured to maintain label information relating to the labels and a forwarding component configured to perform forwarding of the received packets based on the label information; and

wherein for a node in the label switched path, if the link to be used to forward a received packet is a virtual link, the received packet is capable of being forwarded to any ~~one of~~

~~the one or more of the~~ physical links within the virtual link without changing its label that is established in an initial signaling process.

19. (Currently amended) The system of claim 17 wherein the label associated with a packet comprises at least one of ~~is composed of any one of the following entities or combination thereof including~~ a single sequence of bits of fixed length, ~~time slot position in a TDM frame~~ and wavelength of optical carrier.

20. (Canceled)

21. (Original) The system of claim 18 wherein the node in the label switched path further comprises:

a plurality of label forwarding tables, each label forwarding table having a plurality of entries, each entry including an input virtual port number, an input label, an output label and an output virtual port number; and

wherein the input virtual port number represents identification information relating to a virtual link used to receive the packets, the input label represents label information relating to a received packet, the output label represents label information relating to the received packet to be forwarded and the output virtual port number represents identification information relating to a virtual link used to forward the received packet.

22. (Currently amended) A label switching router for use in a multiple protocol label switched network, comprising:

a plurality of wide band virtual links including a plurality of input virtual links and a plurality of output virtual links, each virtual link including ~~input or output virtual link~~ having a plurality of ~~individual~~ physical links;

a control component configured to maintain label information relating to labels carried by packets received via ~~one or more of the~~ input virtual links;

a forwarding component configured to perform forwarding of the received packets based on the label information via ~~one or more of the plural~~ the ty of output virtual links; and

at least one label forwarding table for storing the label information, the at least one label forwarding table having a plurality of entries, each entry having an input virtual port number, an input label, an output label and an output virtual port number;

wherein the label switching router is identified as part of a label switched path for routing packets; and

wherein with respect to the label switched path, the control component is capable of treating ~~either the plurality of individual~~physical links within each input-virtual link ~~or the plurality of individual links within each output virtual link or both~~ as a single entity.

23. (Currently amended) The label switching router of claim 22 wherein the control component ~~does not specify is not concerned with details with respect to which ones of the individual~~physical link ~~links within the output virtual link is are to be used to forward the~~ received packets.

24. (Currently amended) The label switching router of claim 22 wherein at least one of the packets is capable of being forwarded to any one of the plurality of ~~individual~~physical links within an output virtual link without changing its associated label that is established in an initial signaling process.

25. (Currently amended) The label switching router of claim 22 wherein a received packet has an associated input label, the associated input label corresponding to a forwarding equivalence class and an associated output label;

wherein the label switching router uses the associated input label and an input virtual port number associated with the received packet as keys to look up in the at least one label forwarding table the associated output label and an output virtual port number corresponding to an output virtual link through which the received packet is to be forwarded; and

wherein a first hash function operates ~~is used to operate~~ on the associated output label to obtain a hash value, the hash value representing an output practical port number corresponding to one of the plurality of ~~individual~~physical links within the output virtual link through which the received packet is to be forwarded.

26. (Currently amended) The label switching router of claim 25 wherein a second hash function is alternately ~~used to operate~~ operates on the associated output label to obtain a second hash value, the second hash value representing a second one of the plurality of ~~individual~~ physical links within the output virtual link through which the received packet is to be forwarded; and

wherein by alternately using the first and second hash functions, different ones of the plurality of ~~individual~~ physical links within the output virtual link ~~through which the received packet is to be forwarded~~ are capable of being selected without changing the associated output label.

27. (Currently amended) The label switching router of claim 26 wherein by alternately using the first and second hash functions, load balancing for ~~the plurality of~~ individual physical links within the output virtual link ~~through which the received packet is to be forwarded~~ is achieved.

28. (Original) The label switching router of claim 25 wherein for each entry in the at least one label forwarding table, if a hash value of the input label associated with that entry is equal to a predetermined input practical port number, that entry is tagged;

wherein the hash value of the input label associated with that entry is obtained by using a second hash function; and

wherein the first and second hash functions are synchronized.

29. (Currently amended) The label switching router of claim 28 wherein all the tagged entries are copied and stored into an additional label forwarding table; and

wherein the additional label forwarding table is associated with the predetermined input practical port number corresponding to an ~~individual~~ physical link within an input virtual link.

30. (Currently amended) The label switching router of claim 28 wherein when a packet is received via an ~~individual~~ physical link within an input virtual link having the

predetermined input practical port number, only tagged entries are searched with respect to the received packet.

31. (Currently amended) A method for managing virtual links in a label switched network, comprising:

grouping a plurality of ~~individual~~physical links into a plurality of wide band virtual links, each virtual link having ~~one or more~~at least two ~~individual~~physical links, and the plurality of virtual links including a plurality of input virtual links and a plurality of output virtual links;

maintaining a plurality of ingress routers, wherein each ingress router is configured to receive packets and label the packets with associated labels;

maintaining a plurality of label switching routers within the label switched network, wherein each label switching router is configured to receive the labeled packets having respective labels from one of the plurality of ingress routers via ~~one or more~~ input virtual links and forward the received labeled packets via ~~one or more~~ output virtual links, each label switching router further ~~includes~~including a control component configured to maintain label information relating to the labels and a forwarding component configured to perform forwarding of the received labeled packets based on the label information;

maintaining a plurality of egress routers, wherein each egress router is configured to receive the labeled packets forwarded by one of the plurality of label switching routers;

establishing a label switched path having ~~one or more~~at least one label switching ~~router~~routers for routing the labeled packets, wherein ~~one or more~~ virtual links are used to interconnect the label switching routers along the label switched path and the label switching routers along the label switched path communicate with one another via their respective control components to exchange label information to establish the label switched path; and

treating the ~~one or more individual~~physical links within each of the ~~one or more~~ virtual links being used to interconnect the label switching routers along the label switched path collectively as a single entity with respect to the label switched path, wherein the exchanged

label information does not include identification of which ~~details relating to which ones of the individual~~physical links within a virtual link are to be used to forward packets.

32. (Original) The method of claim 31 further comprising:
maintaining a label forwarding table at each label switching router;
wherein the label forwarding table includes a plurality of entries, each entry including an input virtual port number, an input label, an output label and an output virtual port number.

33. (Currently amended) The method of claim 32 wherein each of the labels corresponds to a class ~~a plurality of labels uniquely correspond to a plurality of classes~~.

34. (Currently amended) The method of claim 33 wherein the label switched network comprises ~~is a~~ multiple protocol label switched network and the plurality of class comprises ~~is a~~ plurality of forwarding equivalence classes.

35. (Currently amended) The method of claim 33 further comprising:
for a packet received via an input virtual link:
using an input virtual port number corresponding to the input virtual link and the label of the received packet to look up an output label and an output virtual port number for the received packet in the label forwarding table, the output virtual port number corresponding to an output virtual link through which the received packet is to be forwarded; and
using a first hash function to operate on the output label for the received packet to obtain a hash value, the hash value representing an output practical port number corresponding to ~~an individual~~ a physical link within the output virtual link through which the received packet is to be forwarded.

36. (Currently amended) The method of claim 35 wherein by using the first hash function to operate on the output label for the received packet, the received packet is capable of being forwarded to one of the ~~individual~~ physical links within the output virtual link through which the received packet is to be forwarded, without changing the output label.

37. (Currently amended) The method of claim 35 further comprising:

for the packet received via the input virtual link:

selecting one of a plurality of hash functions to operate on the output label for the received packet to obtain a hash value, the hash value representing an output practical port number corresponding to ~~an individual~~ a physical link within the output virtual link through which the received packet is to be forwarded;

wherein by having the plurality of hash functions, load balancing among the ~~individual~~ physical links within the output virtual link through which the received packet is to be forwarded is achieved.

38. (Original) The method of claim 35 further comprising:

for each entry in the label forwarding table, tagging that entry if a hash value of the input label associated with that entry is equal to a predetermined input practical port number;

wherein the hash value of the input label associated with that entry is obtained by using a second hash function; and

wherein the first and second hash functions are synchronized.

39. (Currently amended) The method of claim 38 further comprising:

copying all the tagged entries in the label forwarding table into an additional label forwarding table; and

associating the additional label forwarding table with the predetermined input practical port number corresponding to ~~an individual~~ a physical link within an input virtual link.

40. (Currently amended) The method of claim 38 further comprising:

when a packet is received via ~~an individual~~ a physical link within an input virtual link having the predetermined input practical port number, searching only the tagged entries with respect to the received packet.

41. (New) A system for managing multiple links in a label switched network,

comprising:

a plurality of virtual links including input virtual links and output virtual links, each virtual link including a plurality of physical links;

a plurality of ingress nodes, each ingress node configured to receive packets and label the packets with associated labels;

a plurality of label switching nodes, each label switching node configured to receive the labeled packets having respective associated labels via an input virtual link and forward the received labeled packets based on their respective associated labels via an output virtual link, each label switching node further including a control component configured to maintain label information relating to the associated labels and a forwarding component configured to perform forwarding of the received labeled packets based on the label information;

a plurality of egress nodes, each egress node configured to receive the labeled packets forwarded from one of the plurality of label switching nodes;

wherein at least one label switching nodes is identified as belonging to a label switched path and virtual links are used to interconnect the identified label switching nodes belonging to the label switched path;

wherein the plurality of physical links within each of the virtual links used to interconnect the identified label switching nodes are collectively regarded as a single entity by the control component with respect to the label switched path;

wherein each associated label belongs to one of a plurality of classes;

wherein the associated labels are used by a label switching node to forward packets belonging to a corresponding class onto one of the plurality of physical links of an output virtual link; and

wherein a first hash function is used to operate on an associated label of a packet to be forwarded via an output virtual link to obtain a hash value, the hash value representing one of the plurality of physical links within the output virtual link that is to be used to forward the packet.

42. (New) A system for setting label switched paths in a label switched network, comprising:

a plurality of links; and
a plurality of nodes interconnected to each other via the plurality of links;
wherein a label switched path is identified for transmitting packets through the label switched network and includes at least one virtual link which includes at least one physical link interconnecting at least two nodes;

wherein each node in the label switched path is configured to receive packets having respective labels via links connected thereto and to forward the received packets based on their respective labels via the links connected thereto;

wherein each node in the label switched path includes a control component configured to maintain label information relating to the labels and a forwarding component configured to perform forwarding of the received packets based on the label information; and

wherein for a node in the label switched path, if the link to be used to forward a received packet is a virtual link, the received packet is capable of being forwarded to any of the physical links within the virtual link without changing its label;

wherein the node in the label switched path further includes control logic configured to select a hash function to operate on respective labels of received packets to obtain corresponding hash values; and

wherein the corresponding hash values represent physical links within the virtual link that are to be used to forward the received packets.

43. (New) A method for managing virtual links in a label switched network, comprising:

grouping a plurality of physical links into a plurality of input and output virtual links, each virtual link including at least one physical link;

maintaining a plurality of ingress routers, each ingress router configured to receive packets and label the packets with associated labels;

maintaining a plurality of label switching routers within the label switched network, each label switching router configured to receive the labeled packets having respective labels from one of the plurality of ingress routers via input virtual links and forward the received

labeled packets via one output virtual links, each label switching router further including a control component configured to maintain label information relating to the labels and a forwarding component configured to perform forwarding of the received labeled packets based on the label information;

maintaining a plurality of egress routers, each egress router configured to receive the labeled packets forwarded by the label switching routers;

establishing a label switched path including at least one label switching router for routing the labeled packets, wherein virtual links interconnect the label switching routers along the label switched path and the label switching routers along the label switched path communicate with one another via their respective control components to exchange label information to establish the label switched path;

treating the physical links within each of the virtual links used to interconnect the label switching routers along the label switched path collectively as a single entity with respect to the label switched path, wherein the exchanged label information does not include identification of which physical link within a virtual link is used to forward packets;

maintaining a label forwarding table including a plurality of entries at each label switching router, each entry including an input virtual port number, an input label, an output label and an output virtual port number, each label corresponding to a class;

for a packet received via an input virtual link, using an input virtual port number corresponding to the input virtual link and the label of the received packet to look up in the label forwarding table an output label and an output virtual port number for the received packet, the output virtual port number corresponding to an output virtual link through which the received packet is to be forwarded; and

using a first hash function operating on the output label for the received packet to obtain a hash value, the hash value representing an output practical port number corresponding to a physical link within the output virtual link through which the received packet is to be forwarded.